Unusual Cause for Maxillofacial Injury

Balasundaram Thanneermalai, Prabodh Kumar Chattopadhyay, K. Kamalpathey, Ravinder Singh Semi, Ajay Premanand Desai, Rahul P. Menon
Department of Oral and Maxillofacial Surgery, Army Dental Centre (R&R), New Delhi, India

Abstract

Penetrating facial injuries are potentially dangerous and may require emergency management because of the presence of vital structures in the face, and it may be life-threatening especially when the injury involves airway, major blood vessels, spinal cord, and cervical spines. Penetrating injuries of the facial region can occur due to missile injuries, blast injuries, motor vehicle accidents, and accidental fall on sharp objects. However, injury to face caused by the shattering of a protective helmet itself is extremely rare. Primary management is targeted to deal with life-threatening conditions and stabilize the patient followed by subsequent care in a well-equipped setting. We present a case of a 30-year-old male, who suffered extensive soft and hard tissue injury of the maxillofacial region due to shattering of a protective helmet causing a ballistic effect.

Keywords: Ballistic injury, blast injury, facial injury

Introduction

Welding helmets are headgear used to protect the eyes, face, and neck from flash burn, ultraviolet light, sparks, infrared light, and heat while performing different type of welding. The modern welding helmet used today was first introduced in 1937 by Wilson Products. Most welding helmets include a window covered with a filter called a lens shade, through which the welder can see to work. In most helmets, the window may be made of tinted glass, tinted plastic, or a variable-density filter made from a pair of polarized lenses. Although the basic function of the helmet is protective, it may prove to be disastrous in rare occasions as in our patient. Penetrating facial injuries due to blast are potentially dangerous and may require emergency management because of the presence of vital structures in the face, and it may be life-threatening especially when the injury involves airway, major blood vessels, spinal cord, and cervical spines. Initial evaluation can classify the ballistic injury into a high- or a low-risk category which ultimately influences the subsequent management.[1,2]

Case Report

A 30-year-old male was brought to the emergency and trauma care center with severe maxillofacial injuries sustained due to shattering of an improvised helmet used during welding process. The shattered helmet has produced multiple splinters which produced a destructive type of injury with lodgments at different parts of the body [Figure 1]. Initial evaluation revealed a semiconscious state with Glasgow Coma Scale of E3V3M4 maintaining oxygen saturation of 92% and blood pressure of 110/60 mmHg. Examination revealed laceration from the left side of chest, severe edema of face with laceration on medial aspect of the right eye with loss of vision [Figure 2], and extensive lacerations over the left side of cheek and angle of mandible. There was bleed from oral cavity and medial aspect of the right eye. Occlusion was grossly deranged. Initial management of the patient was done as per the Advanced Trauma Life Support (ATLS) guidelines with the rapid assessment of airway, breathing, and circulation, and bleeding was managed with external pressure dressing.

Once stabilized, the secondary survey was done with radiographic examination of the head, face, and chest. Computed tomography scan and posteroanterior view skull radiograph revealed a homogenous radiopaque mass superimposing the sphenoidal sinus and multiple radiopaque masses at the angle of mandible suggestive of splinters [Figure 3]. Radiographic examination

Address for correspondence: Dr. K. Kamalpathey, Department of Oral and Maxillofacial Surgery, Army Dental Centre (R&R), Delhi Cantt, New Delhi - 110 010, India.
E-mail: maestrokamal@gmail.com

Access this article online

Quick Response Code:

Website: www.amsjournal.com

DOI: 10.4103/ams.ams_173_17

How to cite this article: Thanneermalai B, Chattopadhyay PK, Kamalpathey K, Semi RS, Desai AP, Menon RP. Unusual cause for maxillofacial injury. Ann Maxillofac Surg 2018;8:166-70.

Figure 1: Preoperative clinical appearance

Figure 3: Preoperative radiograph showing fracture of mandible body and penetrated splinter

of the chest showed a homogenous radiopacity (splinter) at the right 7th intercostal space. Management was done in a multidisciplinary pattern for addressing the intracranial injuries, injury to the eye, comminuted fracture of mandible, and splinter in the chest wall. Individual was taken up for surgery under general anesthesia. Individual was intubated via nasal route. Repair of the soft and hard tissue was done in a systematic manner. Due to the transection of optic nerve on the right side, evisceration of right eye was done along with primary closure of the lacerated wound on the medial aspect of right eye. Removal of splinter in the sphenoidal air sinus was undertaken through endoscopic approach via transnasal route by the otorhinolaryngology surgeon. Splinter in the chest wall was not attempted for retrieval as it was asymptomatic and as advised by cardiothoracic vascular surgeon on consultation. The major impact of the shattering was on the face causing severe disfigurement with a large open wound on the left cheek. Intraorally, there was severe laceration of the left buccal mucosa, retromolar region on the left side with deranged occlusion. Aggressive debridement of intraoral wound was done. As the fracture was severely comminuted, a submandibular approach

Figure 2: Penetrated injury of face

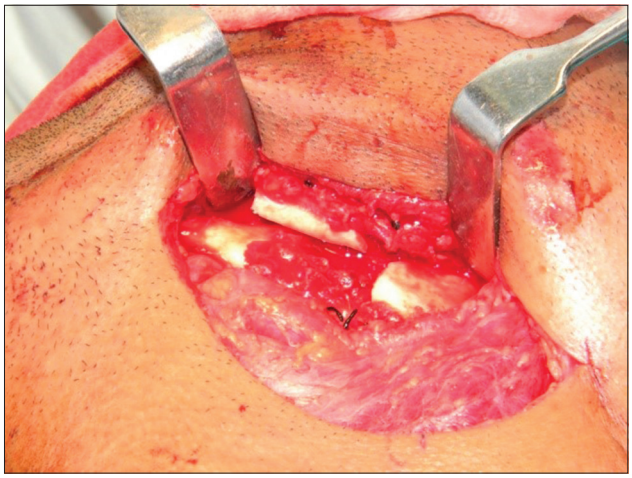

Figure 4: Exposure of the fracture in the mandible

was used and exposure of the fracture fragments along with the splinters was done [Figure 4]. Splinters were removed and reconstruction of the continuity of the lower border of the mandible was done using reconstruction plate and miniplate [Figures 5 and 6]. Individual recovered well postsurgery. The patient developed sialocele postoperatively which was managed conservatively with pressure dressing and cerebrospinal fluid leak with medications and periodic review by a neurosurgeon. Individual was under regular follow-up postoperatively and was rehabilitated with ocular prosthesis on the right side by the prosthodontic team of our institute [Figure 7].

Discussion

Despite the many advances in our understanding of tissue healing, biomaterials, and surgical techniques, the initial assessment, the timing, and the undertaking of management of facial injuries in the early stages have remained a difficult area of patient care. Appropriate and timely management of the facial injuries becomes even more challenging following penetrating injuries. In these circumstances, a number of clinical dilemmas can arise. The American College of Surgeons Committee on Trauma (2008) proposed the following as the three basic principles for primary management of patients with multiple injuries that has been generally accepted as gold standard.[3]

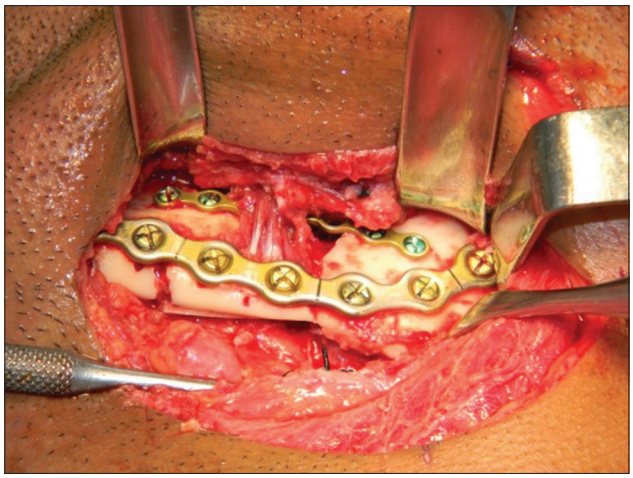

Figure 5: Fixation of fracture segments

Figure 6: Retrieved metallic splinter from the ethmoidal region and sphenoid sinus

Figure 7: Postoperative view after 3 months

1. ABCDEs of assessment (Airway maintenance with cervical spine protection, Breathing with ventilation, Circulation with hemorrhage control, Disability; neurological status, and Exposure/Environment)
2. "Primum nonnocere" (first, do no harm)
3. Treatment of life-threatening injuries within the "golden hour."

Two further well-known principles are also taught on the course.

1. Regularly reassess patients for evolving injuries
2. Importance of the mechanism of injury in anticipating what injuries may be present.

Craniofacial injury should be suspected in a patient with any facial injury who has been unconscious or who demonstrates neurological deficit, abnormal reflexes, convulsion, or delirium. Appropriate neurologic or neurosurgical consultation is mandatory in all cases of suspected head injuries. In those cases in which extensive laceration has occurred and larger vessels have been damaged, clamping the bleeding vessel with hemostats may be the only means of controlling bleeding in the emergency setting. This should, however, be done carefully to avoid injuring important nerves and their branches. For patients with facial trauma undergoing operations, patient safety, functional outcome, and esthetic result are the issues that treating surgeons need to think about.[4,5]

After attending to the airway if multisystem trauma is evident, all of the systemic injuries should be evaluated by the appropriate services before moving the patient from the emergency room to the operating room for the initial management of the facial wound. If open intracranial injuries are present, neurosurgical management figures prominently into the planning of the first procedure. Severe facial trauma defects present with a variety of different structural peculiarities that the surgeon needs to explore and understand. Salivary duct, facial nerve, ear, nose, and eyelid injuries are not life-threatening but cause severe functional impairment to the patient. Due to the extensive collateralization, damage to a single-named vessel in the face requires no specific management other than ligation or clipping of the bleeding vessel to ensure hemostasis. Damage to multiple vessels leading to devitalization of entire subunits of the face is uncommon, and in this eventuality, debridement of the devitalized structure and reconstruction using the subunit principle is used.[6]

Studies point out the importance of early initial debridement of necrotic tissues from severe facial injuries and the importance of beginning antibiotic treatment as soon as possible. This aspect of facial trauma previously dictated that reconstruction begin with soft tissue closure, despite underlying bone loss. The goals of the initial procedure are to address intracranial injuries, debride all foreign material and obviously nonviable tissue, establish and stabilize occlusal relationships in remaining tooth-bearing segments, and perform satisfactory bony reconstruction to maintain the facial soft tissue envelope. During wound debridement, if there is a question about the viability of tissue, it is retained to declare itself within 24–72 h. This is particularly true of skin margins and the tissues of the nose, palate, lips, and medial canthal areas, where the survival of tissues may significantly influence the choice of flap reconstruction or how a particular flap is used for definitive reconstruction. In most cases, occlusion can be established accurately with maxillomandibular fixation. In

cases with a significant palatal or mandibular comminution, the fabrication of dental splints may serve to minimize lingual rotation of mandibular segments when maxillomandibular fixation is applied, assist in establishing the horizontal arch dimension, assist in fracture stabilization, and function as a tension band. Effort should be undertaken at the initial steps to perform enough underlying bone reconstruction to prevent contracture of the facial soft tissues. This goal is addressed at the initial procedure in several ways:

1. Definitive bone grafting in all areas with adequate soft tissue coverage
2. Temporary bone grafting in areas with unsatisfactory soft tissue coverage for interim stenting of the surrounding soft tissues
3. Reconstruction plate fixation with or without locking system for segmental mandibular defects with anticipated definitive bone reconstruction during future surgery.

Finally, the provision of both psychiatric and social service consultation should be undertaken as necessary. Once the patient has been resuscitated, the definitive management of residual deformities has to performed at later date.[7-11]

Parotid gland and duct injuries are far more common than injuries to submandibular and sublingual glands due to its anatomic position. Parotid injuries may involve the gland itself or parotid duct or both. It is very useful to divide injuries into the following: (1) those that involve only the parenchyma of the gland, (2) those that involve the parotid duct, and (3) those that involve both. The most common complications following trauma in the parotid region are sialoceles and fistulas. Prognosis depends on the extent and site of injury as glandular injuries heal faster than ductal injuries and partial duct transection heals faster than complete duct transection. Treatment depends on timing of their appearance, but it generally follows two directions: diversion of parotid secretions into the mouth and depression of parotid secretion. The management includes ligation of the duct or marsupialization of the damaged duct into the oral mucosa and giving antisecretory agents. This leads to gradual decrease in the size of the gland and amount of secretions.[12,13]

Injuries of the facial nerve and its branches in cases of blast injury of the face are multilevel injuries with varying degrees of severity involving part of the facial nerve exiting the parotid gland. There are commonly devitalized segments of nerve present which are nonsalvageable. As in these cases primary nerve repair in the acute setting is not advisable, the management includes tagging the nerve ends and definitive repair at a later date using nerve grafts; transfer of muscles such as temporalis and masseter may be used in cases where nerve regeneration does not occur.[14,15]

Injuries to the pinna in the blast injuries of the face commonly involve lacerations or avulsions of the pinna. Any laceration should be repaired as early as possible in the acute setting to prevent the exposed cartilage from getting devitalized. Avulsion injuries, especially those which lead to part of the pinna being devitalized, need individualized management including judicious debridement and secondary reconstruction at a later date using autologous cartilage or synthetic implants covered by temporalis fascia flap.[16,17]

Injuries to the eye and surrounding adnexae are relatively common features of ballistic injuries involving upper face. Before definitive management, ophthalmologist's evaluation of the visual status is mandatory keeping in mind the high incidence of retinal detachment and vitreous hemorrhage. After ophthalmic evaluation, surgical repair of the eyelid is done in three layers, that is, skin, tarsal plate, and the conjunctiva. Any entropion or ectropion resulting as sequelae may be treated later.[18,19]

Refinement of the nasal reconstruction is performed at this time. The surrounding contracture forces distort all, but the most stable underlying bone or cartilage framework. When cartilage grafts are used in reconstruction of the nasal ala, they should be obtained from the costal margin. Auricular and septal cartilages are too weak to withstand the surrounding scar contracture in these severe injuries and may not maintain a satisfactory contour.[20-22]

If a facial prosthesis (for the nose or other structures) or an ocular prosthesis is to be used, these should be fabricated at this time. For an ocular prosthesis to be retained and have a natural appearance, an adequate conjunctival pocket is required. When a substantial amount of the conjunctiva has been destroyed in the trauma, mucosal grafting is used to restore this depth.

Conclusion

Penetrating injuries in the facial region is an uncommon but may be a potentially life-threatening condition. Diversities in the management protocol with a changing technique compel the clinician to perform a close evaluation of the patient. Each maneuver be directed to minimize the mortality and morbidity by timely intervention and strictly adhering to the principles of Advanced Trauma Life Support (ATLS) protocol to obtain favourable outcome. .

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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